# DATA SHEET

## 74F257A

Quad 2-line to 1-line selector/multiplexer, non-inverting (3-State)

Product specification

1995 Mar 31

IC15 Data Handbook



PHILIPS

# Quad 2-line to 1-line selector/multiplexer, non-inverting (3-State)

# 74F257A

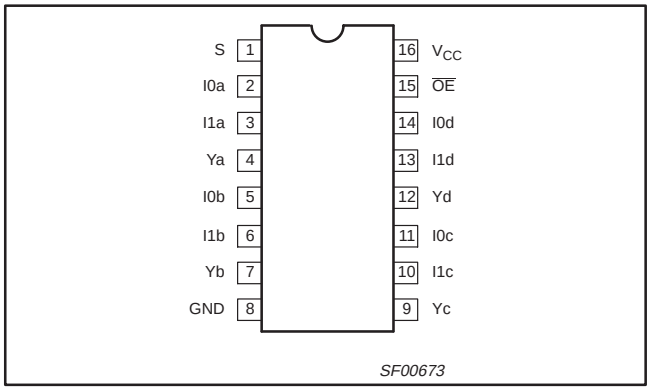
## FEATURES

- Industrial range available (–40°C to +85°C)
- Multifunction capability
- Non-inverting data path
- 3-State outputs
- See 74F258A for inverting version

## DESCRIPTION

The 74F257A has four identical 2-input multiplexers with 3-State outputs which select 4 bits of data from two sources uncer control of a common Select (S) input. The I0a inputs are selected when the common Select input is Low and the I1n inputs are selected when the common Select input is High. Data appears at the outputs in true non-inverted form from the selected inputs. The 74F257A is the logic implementation of a 4-pole, 2-position switch where the position of the switch is determined by the logic levels supplied to the common Slect input. Outputs are forced to a high impedance "off" state when the Output Enable ($\overline{OE}$) is High. All but one device must be in high impedance state to avoid currents that would exceed the maximum rating if the outputs were tied together. Design of the Output Enable signals must ensure that there is no overlap when outputs of 3-state devices were tied together.

## PIN CONFIGURATION




| TYPE | TYPICAL PROPAGATION DELAY | TYPICAL SUPPLY CURRENT (TOTAL) |
|---|---|---|
| 74F257A | 4.3ns | 12mA |

## ORDERING INFORMATION

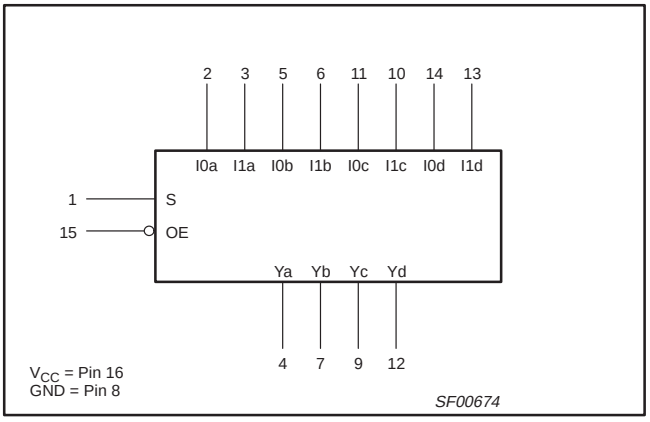
| DESCRIPTION | ORDER CODE | | DRAWING NUMBER |
|---|---|---|---|
| | COMMERCIAL RANGE $V_{CC}$ = 5V ±10%, $T_{amb}$ = 0°C to +70°C | INDUSTRIAL RANGE $V_{CC}$ = 5V ±10%, $T_{amb}$ = –40°C to +85°C | |
| 16-pin plastic DIP | N74F257AN | I74F257AN | SOT38-4 |
| 16-pin plastic SO | N74F257AD | I74F257AD | SOT109-1 |

## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

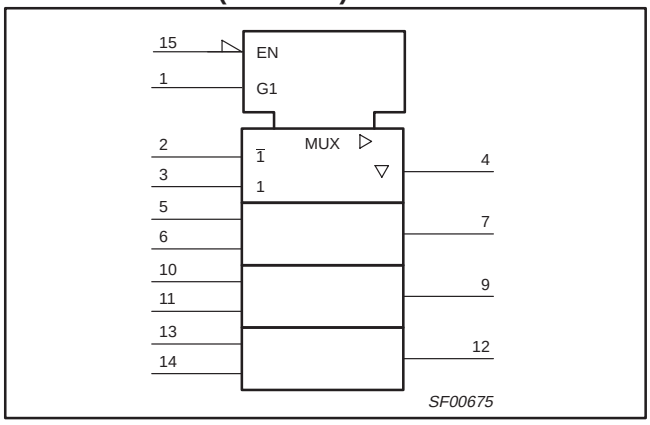
| PINS | DESCRIPTION | 74F (U.L.) HIGH/LOW | LOAD VALUE HIGH/LOW |
|---|---|---|---|
| I0n, I1n | Data inputs | 1.0/1.0 | 20µA/0.6mA |
| S | Common Select input | 1.0/1.0 | 20µA/0.6mA |
| $\overline{OE}$ | Output Enable input (active Low) | 1.0/1.0 | 20µA/0.6mA |
| Ya – Yd | Data outputs | 150/33 | 3.0mA/20mA |

**NOTE:**
One (1.0) FAST unit load is defined as: 20µA in the High state and 0.6mA in the Low state.

## LOGIC SYMBOL




## LOGIC SYMBOL (IEEE/IEC)



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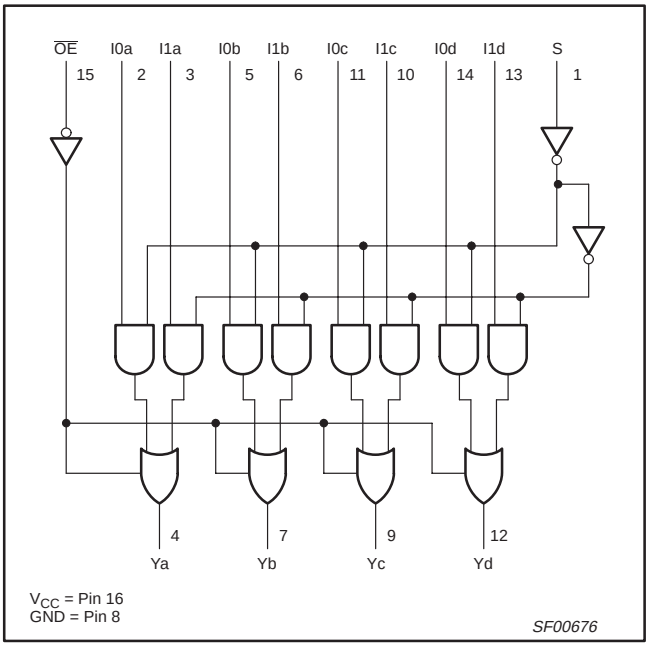
# 74F257A

## LOGIC DIAGRAM

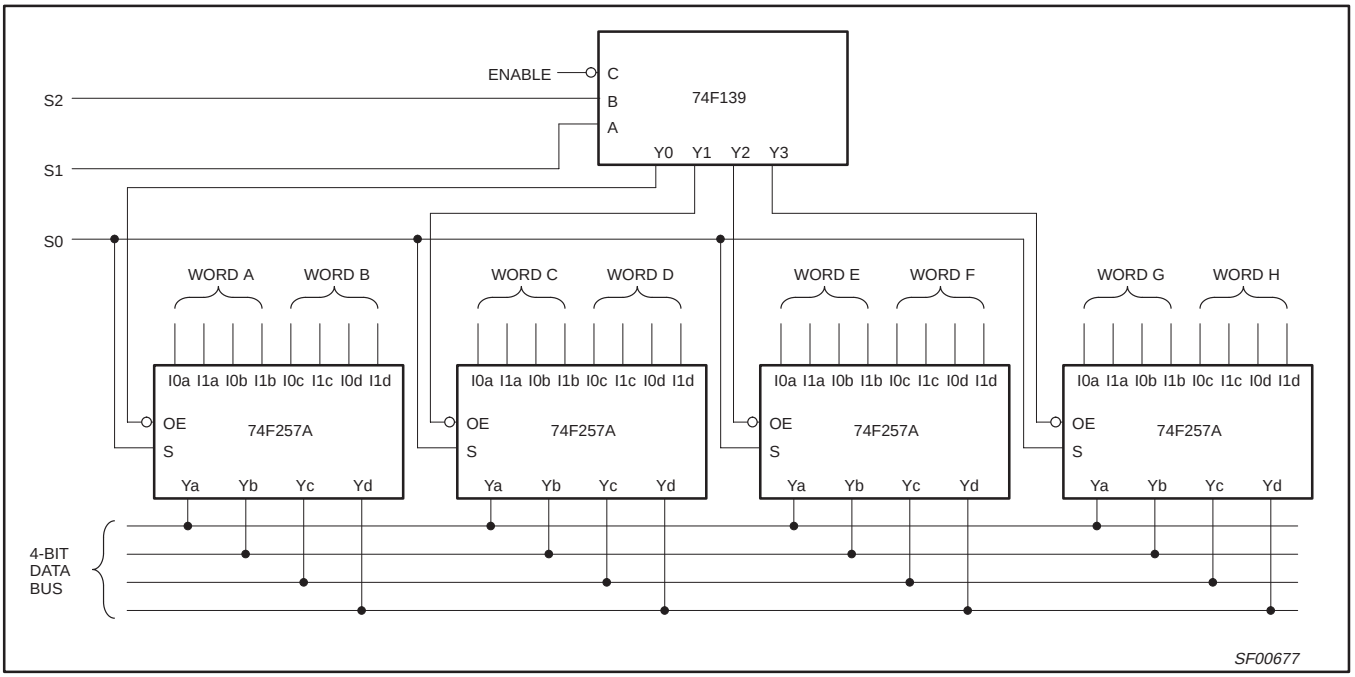



## FUNCTION TABLE

| INPUTS | | | | OUTPUT |
|---|---|---|---|---|
| $\overline{OE}$ | S | I0 | I1 | Y |
| H | X | X | X | Z |
| L | H | X | L | L |
| L | H | X | H | H |
| L | L | L | X | L |
| L | L | H | X | H |

H = High voltage level
L = Low voltage level
X = Don't care
Z = High impedance "off" state

## APPLICATION



## ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limits set forth in this table may impair the useful life of the device.
Unless otherwise noted these limits are over the operating free-air temperature range.)

| SYMBOL | PARAMETER | | RATING | UNIT |
|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | –0.5 to +7.0 | V |
| $V_{IN}$ | Input voltage | | –0.5 to +7.0 | V |
| $I_{IN}$ | Input current | | –30 to +5 | mA |
| $V_{OUT}$ | Voltage applied to output in High output state | | –0.5 to $V_{CC}$ | V |
| $I_{OUT}$ | Current applied to output in Low output state | | 48 | mA |
| $T_{amb}$ | Operating free-air temperature range | Commercial range | 0 to +70 | °C |
| | | Industrial range | –40 to +85 | °C |
| $T_{stg}$ | Storage temperature range | | –65 to +150 | °C |

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | MIN | NOM | MAX | |
| $V_{CC}$ | Supply voltage | | 4.5 | 5.0 | 5.5 | V |
| $V_{IH}$ | High-level input voltage | | 2.0 | | | V |
| $V_{IL}$ | Low-level input voltage | | | | 0.8 | V |
| $I_{IK}$ | Input clamp current | | | | –18 | mA |
| $I_{OH}$ | High-level output current | | | | –3 | mA |
| $I_{OL}$ | Low-level output current | | | | 24 | mA |
| $T_{amb}$ | Operating free-air temperature range | Commercial range | 0 | | +70 | °C |
| | | Industrial range | –40 | | +85 | °C |

## DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

| SYMBOL | PARAMETER | | TEST CONDITIONS[1] | | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP[2] | MAX | |
| $V_{OH}$ | High-level output voltage | | $V_{CC}$ = MIN, $V_{IL}$ = MAX, $V_{IH}$ = MIN, $I_{OH}$ = MAX | ±10%$V_{CC}$ | 2.4 | | | V |
| | | | | ±5%$V_{CC}$ | 2.7 | 3.3 | | V |
| $V_{OL}$ | Low-level output voltage | | $V_{CC}$ = MIN, $V_{IL}$ = MAX, $V_{IH}$ = MIN, $I_{OL}$ = MAX | ±10%$V_{CC}$ | | 0.35 | 0.50 | V |
| | | | | ±5%$V_{CC}$ | | 0.35 | 0.50 | V |
| $V_{IK}$ | Input clamp voltage | | $V_{CC}$ = MIN, $I_I$ = $I_{IK}$ | | | –0.73 | –1.2 | V |
| $I_I$ | Input current at maximum input voltage | | $V_{CC}$ = MAX, $V_I$ = 7.0V | | | | 100 | µA |
| $I_{IH}$ | High-level input current | | $V_{CC}$ = MAX, $V_I$ = 2.7V | | | | 20 | µA |
| $I_{IL}$ | Low-level input current | | $V_{CC}$ = MAX, $V_I$ = 0.5V | | | | –0.6 | mA |
| $I_{OZH}$ | Off state output current, High-level voltage applied | | $V_{CC}$ = MAX, $V_O$ = 2.7V | | | | 50 | µA |
| $I_{OZL}$ | Off state output current, Low-level voltage applied | | $V_{CC}$ = MAX, $V_O$ = 0.5V | | | | –50 | µA |
| $I_{OS}$ | Short-circuit output current[3] | | $V_{CC}$ = MAX | | -60 | | –150 | mA |
| $I_{CC}$ | Supply current[4] (total) | $I_{CCH}$ | $V_{CC}$ = MAX | | | 9.0 | 15.0 | mA |
| | | $I_{CCL}$ | | | | 14.5 | 22.0 | mA |
| | | $I_{CCZ}$ | | | | 15.0 | 23.0 | mA |

**NOTES:**

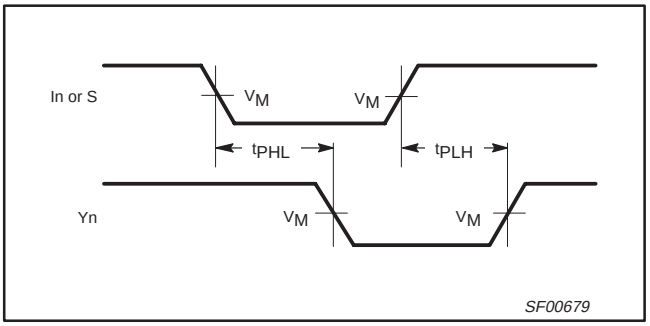
1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at $V_{CC}$ = 5V, $T_{amb}$ = 25°C.
3. Not more than one output should be shorted at a time. For testing $I_{OS}$, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, $I_{OS}$ tests should be performed last.
4. Measure $I_{CC}$ with all outputs open and inputs grounded.

## AC ELECTRICAL CHARACTERISTICS

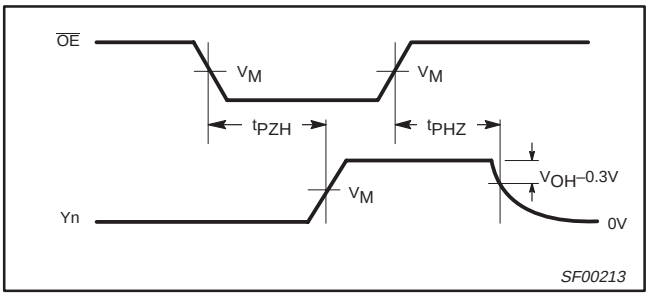
| SYMBOL | PARAMETER | TEST CONDITION | LIMITS | | | | | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $T_{amb}$ = +25°C, $V_{CC}$ = +5.0V, $C_L$ = 50pF, $R_L$ = 500Ω | | | $T_{amb}$ = 0°C to +70°C, $V_{CC}$ = +5.0V ± 10%, $C_L$ = 50pF, $R_L$ = 500Ω | | $T_{amb}$ = –40°C to +85°C, $V_{CC}$ = +5.0V ± 10%, $C_L$ = 50pF, $R_L$ = 500Ω | | |
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay In to Yn | Waveform 1 | 3.0<br>2.0 | 4.5<br>3.5 | 6.0<br>5.0 | 3.0<br>2.0 | 7.0<br>6.0 | 3.0<br>2.0 | 7.0<br>7.0 | ns |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay S to Yn | Waveform 1 | 5.0<br>4.0 | 7.5<br>5.5 | 9.5<br>7.0 | 5.0<br>4.0 | 10.5<br>8.0 | 5.0<br>4.0 | 10.5<br>8.5 | ns |
| $t_{PZH}$<br>$t_{PZL}$ | Output Enable time to High or Low level | Waveform 2<br>Waveform 3 | 4.5<br>4.5 | 6.5<br>6.0 | 7.5<br>7.5 | 4.5<br>4.5 | 8.5<br>8.5 | 4.5<br>4.5 | 8.5<br>8.5 | ns |
| $t_{PHZ}$<br>$t_{PLZ}$ | Output Disable time from High or Low level | Waveform 2<br>Waveform 3 | 2.0<br>2.0 | 4.0<br>3.5 | 5.5<br>5.5 | 2.0<br>2.0 | 6.0<br>6.0 | 2.0<br>2.0 | 6.0<br>6.0 | ns |

## AC WAVEFORMS

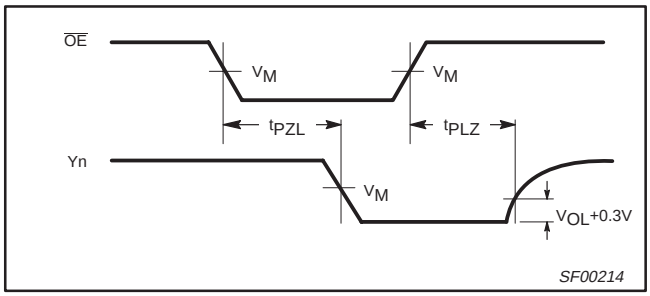
For all waveforms, $V_M$ = 1.5V.




**Waveform 1. Propagation Delay, Data and Select to Output**

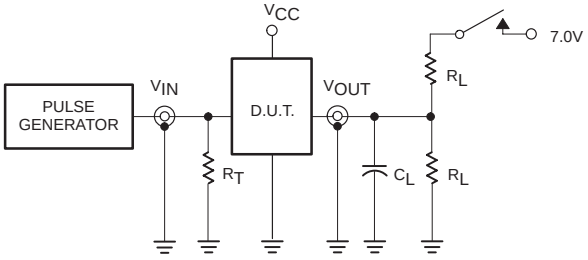



**Waveform 2. 3-State Output Enable Time to High Level and Output Disable Time from High Level**

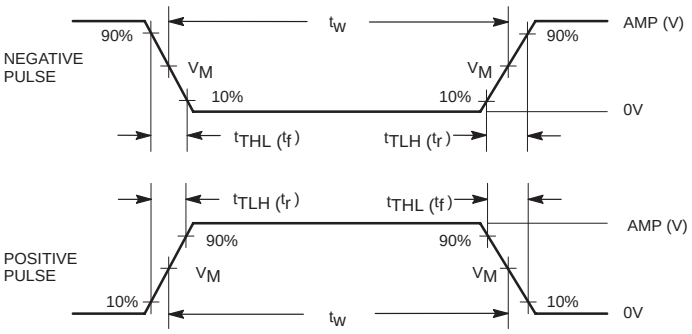



**Waveform 3. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level**

## TEST CIRCUIT AND WAVEFORMS




**Test Circuit for 3-State Outputs**




**Input Pulse Definition**

**SWITCH POSITION**

| TEST | SWITCH |
|---|---|
| $t_{PLZ}$ | closed |
| $t_{PZL}$ | closed |
| All other | open |

**DEFINITIONS:**

$R_L$ = Load resistor; see AC electrical characteristics for value.

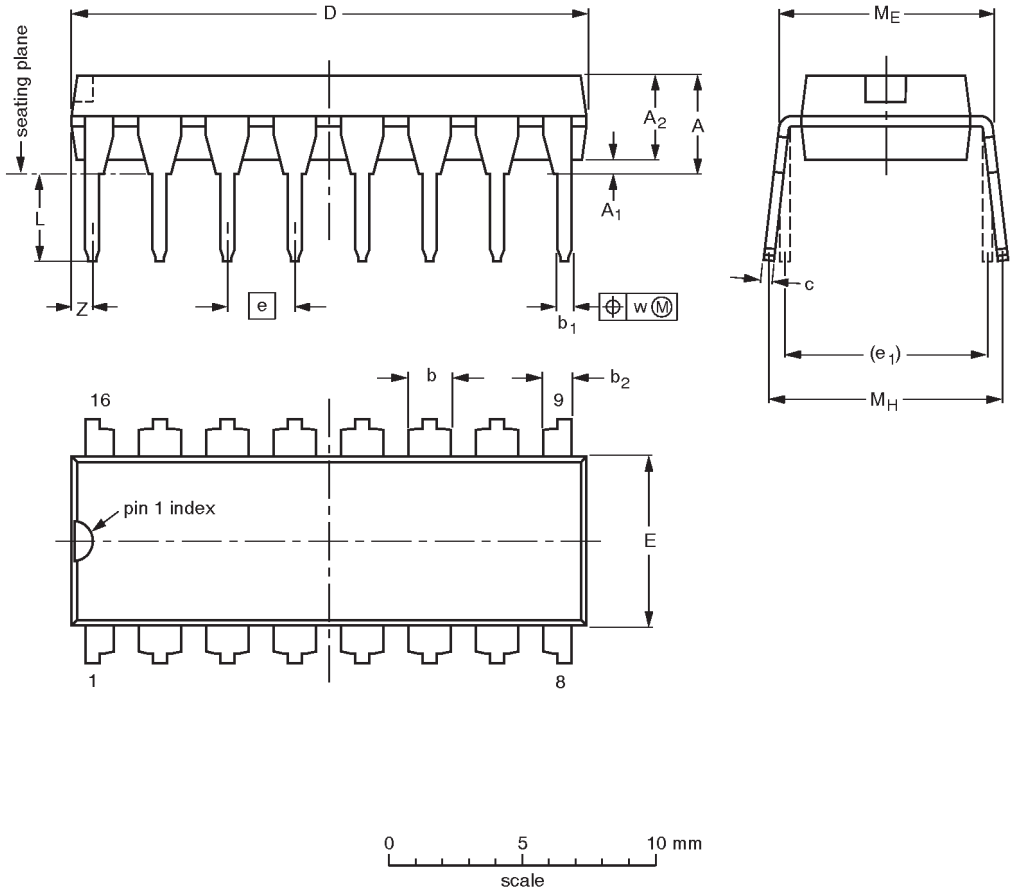
$C_L$ = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.

$R_T$ = Termination resistance should be equal to $Z_{OUT}$ of pulse generators.

| family | INPUT PULSE REQUIREMENTS | | | | | |
|---|---|---|---|---|---|---|
| | amplitude | $V_M$ | rep. rate | $t_w$ | $t_{TLH}$ | $t_{THL}$ |
| 74F | 3.0V | 1.5V | 1MHz | 500ns | 2.5ns | 2.5ns |

SF00777

**DIP16: plastic dual in-line package; 16 leads (300 mil)** **SOT38-4**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

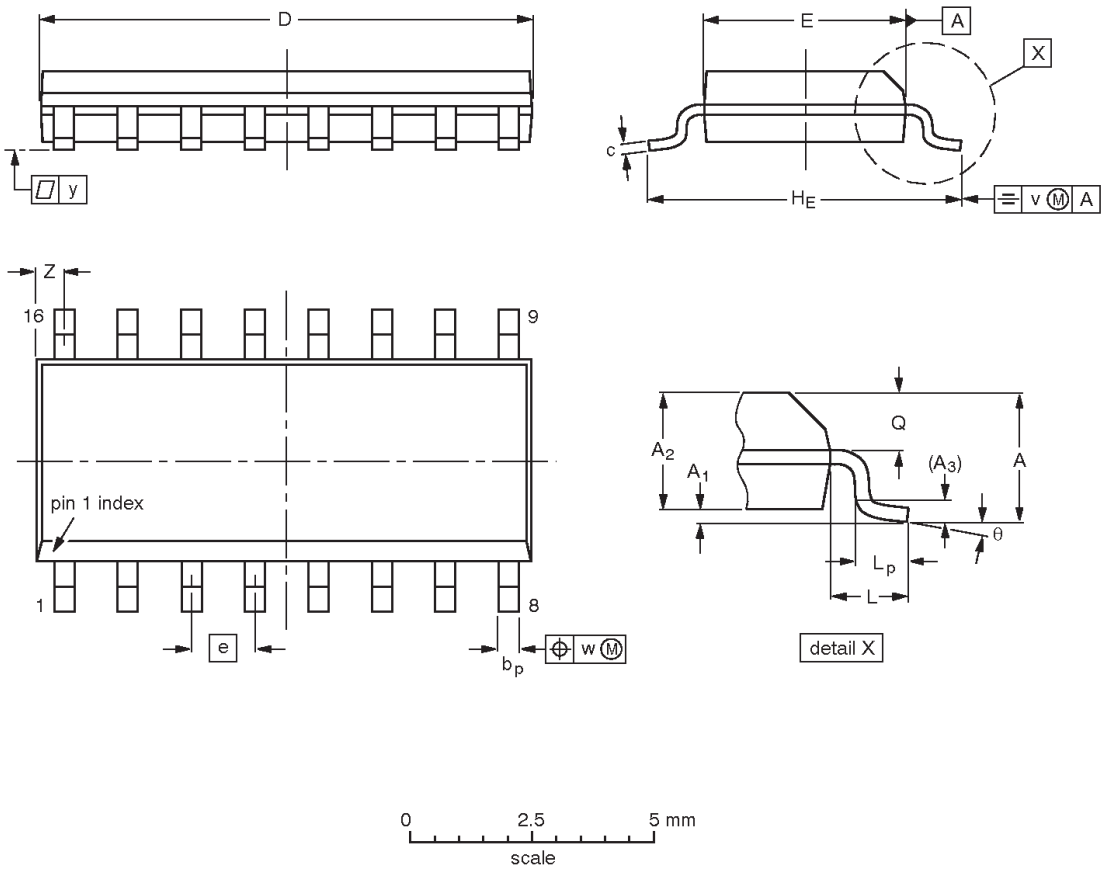
| UNIT | A max. | $A_1$ min. | $A_2$ max. | b | $b_1$ | $b_2$ | c | D (1) | E (1) | e | $e_1$ | L | $M_E$ | $M_H$ | w | Z (1) max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.2 | 0.51 | 3.2 | 1.73<br>1.30 | 0.53<br>0.38 | 1.25<br>0.85 | 0.36<br>0.23 | 19.50<br>18.55 | 6.48<br>6.20 | 2.54 | 7.62 | 3.60<br>3.05 | 8.25<br>7.80 | 10.0<br>8.3 | 0.254 | 0.76 |
| inches | 0.17 | 0.020 | 0.13 | 0.068<br>0.051 | 0.021<br>0.015 | 0.049<br>0.033 | 0.014<br>0.009 | 0.77<br>0.73 | 0.26<br>0.24 | 0.10 | 0.30 | 0.14<br>0.12 | 0.32<br>0.31 | 0.39<br>0.33 | 0.01 | 0.030 |

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT38-4 | | | | | | ~~92-11-17~~<br>95-01-14 |

**SO16: plastic small outline package; 16 leads; body width 3.9 mm** **SOT109-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.75 | 0.25<br>0.10 | 1.45<br>1.25 | 0.25 | 0.49<br>0.36 | 0.25<br>0.19 | 10.0<br>9.8 | 4.0<br>3.8 | 1.27 | 6.2<br>5.8 | 1.05 | 1.0<br>0.4 | 0.7<br>0.6 | 0.25 | 0.25 | 0.1 | 0.7<br>0.3 | $8^o$<br>$0^o$ |
| inches | 0.069 | 0.010<br>0.004 | 0.057<br>0.049 | 0.01 | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.39<br>0.38 | 0.16<br>0.15 | 0.050 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.020 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012 | |

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT109-1 | 076E07S | MS-012AC | | | | ~~95-01-23~~<br>97-05-22 |

**NOTES**

## DEFINITIONS

| Data Sheet Identification | Product Status | Definition |
|---|---|---|
| *Objective Specification* | Formative or in Design | This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice. |
| *Preliminary Specification* | Preproduction Product | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |
| *Product Specification* | Full Production | This data sheet contains Final Specifications. Philips Semiconductors reserves the right to make changes at any time without notice, in order to improve design and supply the best possible product. |



**Philips Semiconductors**
**811 East Arques Avenue**
**P.O. Box 3409**
**Sunnyvale, California 94088–3409**
**Telephone 800-234-7381**



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